REMARKS

This amendment is intended to be fully responsive to the Official Action mailed September 16, 2005 in the above referenced application.

In view of the content of the outstanding First Office Action, the Applicant has provided a new title drafted in accordance with the Examiner's suggestions, an amended abstract reduced in the number of words to stay within the limit of 150 words as recommended by the Examiner, and an amended set of claims 13 to 24 which replace claim 1 to 12 as originally filed.
New claims 13 to 24 contain the same subject matter of original claims 1 to 12; however, they have been amended in order to take care of the Examiner's formal objections raised and in view to overcome rejection under 35USC 112; all the amendments have the sole aim to improve clarity, to better meet the US draft practice and to better define the invention, in particular over the prior art applied. No new matter has been introduced, all the amendments made being fully supported by the description and claims as originally filed, and by the drawings, see especially figure 2, where the template is clearly illustrated as being openable (and operable) like a book, and figure 1.

Moreover, in order to avoid any possible confusion, the confusing translation of the Italian terms "complesso" and "assemblato", which have been rendered both with the same English term of "assembly", the sub-unit formed by the bars and the core during the assembling operations of Claim 2 has been indicated as a "semi-finished" assembly, to distinguish it from the completed assembly (unit formed by the core, the bars and the external tube); finally, still to avoid any possible confusion, the term "bar-like semi finished product" has been deleted throughout the claims and replaced with the term "assembly of said predetermined dimension"; of course, to subject the assembly obtained according to claim 1 to a number cold drawing

operations (like those as described – e.g. page 13, lines 18-25 - and shown in figure 1) inevitably brings the assembly to assume predetermined dimension, which are of course the "*required dimensions*" under the circumstance.

Last but not least, in order to better distinguish over the prior art applied, original claims 1 and 2 have been merged together as new claim 13, except for the last paragraph of original claim 2, that now constitutes the entire subject matter of new claim 14.

The drawings were objected to for failing to illustrate the subject matter of claim 11. In order to overcome the objection raised in relation to the drawings under 37 CFR 1.83(a), the subject matter of original Claim 11 (now new claim 23), which is not shown in the drawings, has been deleted without prejudice.

Coming now to the rejection under 35USC 102(b), the Applicant's position is as follows. The gist of the present invention consists in the discovery that in case of **NbTi** superconductor cables, the critical current may be improved well over the 20% (keeping the remaining all other parameters, like chemical composition, section, length, etc., constant) reducing at a minimum the heating steps required in the fabrication process, and in particular avoiding any plastic deformation operation carried out at high temperature, like hot rolling, hot drawing , hot swaging, etc.

The main reasons why heating steps at a relatively high temperature (e.g. above 400°C), that may so affect the critical current finally available, are carried out during a superconducting cable fabrication process are two:

- Firstly, hot drawing or hot rolling operations lead normally to less expensive processes, since a major reduction in the overall cross-section dimensions (and a major increase in length) may be obtained by a single passage/operation; accordingly, the number of e.g.

drawing steps necessary to reach predetermined dimensions are reduced, so reducing the overall cost of the process;

- Secondly, even when solely cold drawing or cold rolling operations were used, the necessity to shape the starting bars with an hexagonal cross-section (in order to ensure a more precise relative positioning of the superconducting cores) leads to the necessity to carry out repeatedly annealing operations (at a relatively high temperature) between each drawing/rolling step and the successive one, since the edges and especially the corners of the bar sections are subject to a more intense work-hardening that renders them very brittle. Even if hexagonal cross-section were avoided, nevertheless the necessity of carrying out repeatedly annealing operations still would remain, since, in order to keep the number of cold deforming operations at a minimum, each operation should be carried out very close to the physical limits, so giving rise to an intense work-hardening of the superconducting alloy as well.

In practice, the only way that was known before the present invention in order to keep the necessity of annealing operations at a minimum, was to carry out a dramatically large number of cold deformation steps, each tailored to obtain a very small change in the overall dimensions of the element under working. But such a large number of very limited (in the dimension changes) deformation steps lead inevitably to extremely high working costs and to a very time consuming process.

By the way, the part of the process where the cold deformation steps are to be kept relatively "soft" (in the sense that they have to be tailored in order to obtain very limited variations in the overall dimensions of the work) is just the initial part, namely the **first cycle of deformation steps** bringing the work from the starting assembly to a semi finished bar of

reduced cross-section and increased length, that may then be subjected to a standard cold drawing process to obtain wires.

The possibility to start with an assembly of reduced cross-section and increased length would then lead to a dramatic reduction in the number of cold deformation operation necessary to obtain a semi-finished bar able to be fed to the standard cold drawing process to obtain wires. This would lead consequently to a less extent of work-hardening and a less necessity to annealing, at the same time keeping the overall cost of the working process substantially **low**. Marancik'431 (US-A-4,860,431) does not relate to NbTi superconductors, but to Nb_3Sn superconductors (see, e.g. column 1, line 9, and the whole description). The passage in Marancik referred to by the Examiner does NOT relate to the process described in this reference, but to the process described in US-A-4,646,428 in the name of the same inventor (hereinafter referred to as Marancik'428). Here, the necessity to avoid hot drawing or hot rolling operations is not directly connected to obtain an increase in the critical current, BUT to avoid a chemical reaction between Sn and Cu, that could lead to the formation of bronze, which is to be avoided (the two Marancik patents just want to overcome the drawbacks of the "bronze process" due to the technologic limits of bronze). By the way, the process involve the formation of bars **in hexagonal shape** (see e.g. Marancik'428, column 4, line 12).

In conclusion, **both Marancik fail to teach or even suggest a NbTi superconductor cable obtained solely through cold drawing operations**.

Moreover, the process taught for obtaining the starting assembly is entirely traditional. In such a traditional process, the starting bars, either hexagonal or cylindrical in cross-section, are to be kept in place before to be blocked by subsequent process steps; this is accomplished by assembling the bars onto/within the core/tube of copper **keeping them vertical**, as well as the

copper core/tube. This inevitably leads to keep the initial length of the assembly so obtained very short., otherwise, mechanical instability problems could arise. This means that in order to obtain a semi finished bar able to be subjected to a standard cold drawing process to obtain wires a large reduction in cross-section dimension is to be accomplished through the initial cycle of cold deformations, with all the drawbacks described above that such a necessity involves. Woolcock (US-A-3,686,750) relates to method for fabricating NbTi superconductor wires. However, in the passage referred to by the examiner (column 3, lines 47-50) it refers to the possibility to carry out the necessary swaging or drawing operations upon the assembly formed by the superconducting bars, the copper core and the copper tube surrounding them, **EITHER at room temperature (i.e. by cold working) OR at elevated temperature of up to 800°C (i.e. by hot working)**.

Therefore **Woolcock fails to acknowledge the criticality of carrying out solely cold working operations** in forming superconductor cables based on NbTi alloys. Accordingly, it does **NOT actually teach (and even does NOT suggest) to obtain a NbTi superconducting cable by cold working only so as to obtain an improved critical current**.

As far as the Woolcock's process steps are concerned, this reference teaches to use superconductor starting bars shaped in cylindrical cross-section, which are retained in position by being inserted in radial grooves provided upon the outer surface of the copper core; they are then retained within the grooves after the assembly by means of an outer copper tube, which is inserted over the core.

First of all, such a process leads necessarily to a superconductor wire having a relatively low critical current at a certain overall cross-section, since in order to have the room to provide

the radial grooves to house the bars, the **bars cannot be placed very close to each other**. Then a limited cross-sectional area made of superconducting alloy remains available in the end. Secondly, before the outer tube is inserted, nothing is able to keep the bars inside the grooves, e.g. against the force of gravity; accordingly, the process of Woolcock is likely to be carried out in a traditional manner too, e.g. keeping the bars, the core and the tube vertical; this leads to employ bars of a limited length, with the same drawbacks already highlighted for Marancik.

In the end, none of the cited reference teaches or suggests a NbTi superconductor cable according to the content of Claim 12 actually pending in the present application (i.e. having an increased critical current at parity of cross-section overall dimensions and chemical composition):

Likewise, none of the cited references teaches or even suggest the method according to amended claim 1 now pending in the present application, wherein the superconducting bars are cylindrical and are kept close (in contact, i.e. without any play) to each other, handling the bars, the core and the external tube keeping them horizontal, being fully supported during the whole process by the template, the ties and the rings that are applied in the sequence recited in claim 1. In this manner the initial length of the assembly obtained before starting with the cold drawing operations may be already considerable, allowing the number of necessary drawing operation to be reduced. In the end, the process according to the invention through the totally new (and not obvious) way of handling the assembly of the bars upon the core and within the external tube/sheath, allows the number of necessary annealing operations to be dramatically reduced and to carry out them at lower temperatures, leading to a **process which is more economical, quicker and less energy consuming** (so being safer for the environment), and to NbTi cables of improved performances.

On the grounds of what explained above, the Applicant is of the opinion that the amended claims in the file are now clear, new and not obvious over the prior art applied and are also well defined in the subject matter the protection is sought for.

Accordingly a favorable re-examination is respectfully requested and the allowance of the new claims in the file respectfully solicited.

Should the PTO believe that further discussion would advance prosecution of this matter, please contact the undersigned.

Respectfully submitted,

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